Patent claims

1. A planar fuel cell system with at least two fuel cells which are electrically connected in series in a plane via horizontally overlapping connecting lugs (8, 8', 14, 14', 40, 17, 17', 18, 18') and in each case on the anode side (10) and on the cathode side (11) comprise current collectors (1) which are electrically connected to the connecting lugs (8, 8', 14, 14', 40, 17, 17', 18, 18'), and a polymer electrolyte membrane (3), wherein the current path is led around the polymer electrolyte membrane (3),
characterised in that
the fuel cell system is designed with a [printed] circuit board technique and as a composite of a first, anode-side [printed] circuit board (10) and a second, cathode-side [printed] circuit board (11), and the current collectors (1) and connecting lugs (8, 8', 14, 14', 40, 17, 17', 18, 18') are designed as strip conductors of these [printed] circuit boards.

2. A fuel cell system according to claim 1, characterised in that the connecting lugs (8, 8', 14, 14', 40, 17, 17', 18, 18') are located within the boundary of the [printed] circuit board composite.

3. A fuel cell system according to one of the claims 1 or 2, characterised in that the connecting lugs (8, 8', 14, 14', 40, 17, 17', 18, 18') in their overlapping region in each case are connected by way of at least one perpendicular contacting element (9).

4. A fuel cell system according to claim 3, characterised in that the at least one perpendicular contacting element (9) is a bore filled with an electrically conductive material.

5. A fuel cell system according to claim 5, characterised in that the electrically conductive material (9) is solder or an electrically conductive adhesive.

6. A fuel cell system according to one of the claims 4 or 5, characterised in that the bore (9) is metallised on its inner side.

7. A fuel cell system according to claim 3, characterised in that the at least one perpendicular contacting element is a rivet (9).

8. A fuel cell system according to one of the preceding claims 1 to 7, characterised in that gas distribution structures (6) are incorporated into the first, anode-side [printed] circuit board.

9. A fuel cell system according to one of the claims 1 to 8, characterised in that gas distribution structures (6) are incorporated into the second, cathode-side [printed] circuit board.

10. A fuel cell system according to one of the claims 1 to 8, characterised in that air openings to the outside are incorporated into the second, cathode-side [printed] circuit board.

11. A fuel cell system according to one of the claims 1 to 10, characterised in that the fuel cells in each case have a reaction region (12) which is incorporated into the [printed] circuit board and which is circumscribed by a raised part (13) of [printed] circuit board material and/or lacquer.

12. A fuel cell system according to one of the claims 1 to 11, characterised in that the reaction region contains a gas distribution structure (6) and a current collector (1), and a diffusion layer (2) is provided which is deposited onto the current collector (1) in a flat manner.

13. A fuel cell system according to one of the claims 1 to 12, characterised in that the diffusion layer (2) is designed as a plastic fabric provided with metallised segments.

14. A fuel cell system according to one of the claims 1 to 13, characterised in that the strip conductors (1, 8, 8', 14, 14', 40, 17, 17', 18, 18') and/or the outer contacts (5, 5') contained in the fuel cell system are coated with single-ply or multi-ply electrically conductive layers to avoid corrosion.

15. A fuel cell system according to one of the claims 1 to 14, characterised in that the polymer electrolyte membrane (3) is designed as a segmented membrane electrode assembly (MEA).

16. A fuel cell system according to one of the claims 1 to 15, characterised in that on the surface of the [printed] circuit board composite it comprises an electronic circuit.

17. A fuel cell system according to one of the claims 1 to 16, characterised in that the connecting lugs (18, 18') of the first and of the second [printed] circuit board are arranged on these in each case on the reaction region side and are electrically contacted in a permanent manner by way of a welding connection.

18. A planar fuel cell system with at least two fuel cells which via strip conductors (25) are electrically connected in series in a plane and which comprise current collectors (1, 1') electrically connected to the connection elements (25), and a polymer electrolyte membrane (3), wherein the current path is led around the polymer electrolyte membrane (3),
characterised in that
the fuel cell system is designed in a [printed] circuit board technique and as a composite of a first [printed] circuit board (21) and a second [printed] circuit board (22), and the current collectors (1, 1') and connection elements (25) are designed as strip conductors of these [printed] circuit boards, wherein the [printed] circuit boards in each case comprise alternating anode and cathode gas distribution structures and wherein in each case one adjacent anode current collector (1) and cathode current collector (1') is electrically connected by way of the connection element (25).

19. A method for manufacturing a fuel cell system according to one of the preceding claims, wherein a first and a second [printed] circuit board carrier (substrate) (10, 11) in each case is selected with an upper side and a lower side, and for both carriers (substrates) on the upper side in each case the steps of

- depositing the metallisation onto the [printed] circuit board carrier (substrate) so that a [printed] circuit board arises, wherein metal films or thin sheets from a selection of the materials copper, nickel, gold, titanium or stainless steel and/or an alloy of these is laminated onto the [printed] circuit board material, or the metallisation is realised by way of coating (sputtering, vapour deposition) and a subsequent galvanic reinforcement of the layer

- selective etching-away or milling of the metallisation so that strip conductors arise which in the reaction spaces (12) form current collectors (1) and connecting lugs (8, 8', 14, 14', 17, 17', 25) which in each case border these in a smooth manner

- incorporating the gas distribution structures (6) into the [printed] circuit board

- depositing the diffusion layers (2)

are carried out and subsequently the membrane-electrode-assembly (MEA) (3) is deposited onto the upper side of the first [printed] circuit board (10), the first (10) and the second (11) [printed] circuit board with their upper sides facing one another are joined together and the connecting lugs (8, 8', 14, 14', 40, 17, 17', 18, 18') are connected to one another in a perpendicular manner.

20. A method according to claim 19, characterised in that as a membrane electrode assembly (MEA) (3) an MEA catalytically coated over the whole surface is selected and is segmented before deposition onto the [printed] circuit board.

21. A method according to claim 20, characterised in that the segmentation of the MEA (3) is incorporated by way of laser ablation and/or reactive ion etching.

22. A method according to one of the claims 19 to 21, characterised in that after the incorporation of the gas distribution structures, a raised part surrounding the reaction spaces (12) is deposited so that in each case a recess arises in the region of the reaction spaces.